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Jay S. Hammond, Governor

Completion Report

POND REARING OF KING AND COHO SALMON

by

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Section N

Study AFS 43
Mendenhall Anadromous Fish
Rearing Ponds

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Pond Rearing of King and Coho Salmon — Michael Bethers
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COMPLETION REPORT

State:	Alaska	Name:	Sport Fish Investigations of Alaska
Study No.:	AFS 43	Study Title:	MENDENHALL ANADROMOUS FISH REARING PONDS
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Period Covered: July 1, 1972 to June 30, 1978.

ABSTRACT

From 1973 through 1977, experiments at Mendenhall Lakes were designed to: (1) determine feasibility of producing salmon smolts by pond rearing techniques in semi-natural lakes and in freshwater pens in Moose Lake; (2) compare returns to the fisheries and Mendenhall Facility of pond reared smolts, pen reared smolts, and hatchery reared smolts released from the facility; (3) provide a lot of pond reared coho for overwintering and spring release from Fish Creek Estuarine Rearing Facility and to evaluate returns of this release to the fisheries; (4) determine feasibility of imprinting saltwater reared smolts to freshwater release sites; and (5) determine the most desirable brood stock of coho for use in improving the Juneau area fisheries.

Of 603,729 coho fry stocked at the Mendenhall Facility from 1973 to 1976, a total of 168,899 fish or 28% were released from the lakes, and fry to smolt production averaged 20.5% annually. Survival of a single brood of spring king salmon reared in Moose Lake was 95,731/155,078 and smolt survival was 93,731 or 60.4%.

Survival of pen reared coho was higher than that of the pond reared coho released the same year. The average size of pond reared coho was greater than that of pen reared coho. Fry to smolt survival from planting to release was 28.8% in Moose Lake, 42.3% in a pen stocked with 10,000 fry and 49.4% in a pen stocked with 5,000 fry. Moose Lake reared smolt averaged 52.9/kg at release compared to 70.6/kg for smolts from the pen stocked with 5,000 fry and 90.4/kg for smolts from the pen stocked with 10,000 fry.

The average rate of return of marked fish from pond reared coho smolt has been 2.83% compared to .48% for freshwater pen reared coho and .80% for hatchery reared coho smolts released from the facility.

Of 688 spring king salmon returning to the Mendenhall Facility in 1976 and 1977, a total of 522 (76%) were from pond reared smolts and 166 (24%) have

been from hatchery reared smolts released from the facility. Total accumulated return rates for pond reared smolts was .61% compared to .15% for hatchery reared smolts.

Studies now in progress in which complete data have not been collected include: (1) evaluation of pond reared smolts released into salt water, (2) evaluation of returns to the Mendenhall Facility of saltwater reared coho smolts, and (3) determination of the most desirable stock of coho for use in improving the Juneau area fisheries.

BACKGROUND

A declining catch per unit of fishing effort in the Juneau area salmon sport fishery prompted the Sport Fish Division to study the feasibility of providing additional salmon for the fishery by pond rearing salmon to smolt stage in existing lakes in the Mendenhall Valley north of Juneau. The project was first envisioned in 1968. The potential rearing lakes were situated on Forest Service land, so a cooperative agreement between the Department of Fish and Game and the U.S. Forest Service was written and the Mendenhall Salmon Rearing Facility was begun. Both agencies participated in the original planning and engineering of the facility. These plans called for the pond rearing of king, Oncorhynchus tshawytscha (Walbaum), and coho, O. kisutch (Walbaum), fry to the smolt stage in three lakes.

Capital improvement construction began in 1972 and included dredging of one lake, constructing a holding pond, and dredging channels linking the lakes to a common outlet. Several dikes, concrete control structures, and two roads were also constructed. Salmon fry were first planted in Norton, Dredge and Moose lakes in 1973.

During the first year of fish rearing operations (1973), effort was directed toward determining the feasibility of producing salmon smolts by pond rearing methods in Norton, Dredge and Moose lakes (Bethers, 1974). In spring 1974, a total of 81,425 coho smolts were released from Norton and Dredge lakes, and 93,129 king salmon smolts were released from Moose Lake.

During the first year of operation, engineering problems were encountered which precluded further use of Dredge and Norton lakes for rearing. The flow from Moose Lake, where the original outlet structure was situated, was also inadequate to attract salmon smolts. However, access around the lake was good and the lake could be easily seined after lowering the water level by pumping. It was decided to reduce the scope of the rearing facility and to determine its usefulness through the rearing of fish in only Moose Lake. If the project was determined to be useful and monies were available, then Norton and Dredge lakes could be put back into production.

Moose Lake was restocked with rearing coho on September 16, 1974. These fish were of two different sizes, 109,500 at 403/kg (183/lb) and 99,985 at 176/kg (80/lb) and averaged 280/kg (127/lb) after two days mixing in the lake. In May, 1975 only 10,167 coho were found surviving in Moose Lake.

The low survival could have been due to: (1) rapid changes in water temperature, (2) predation by common mergansers, or (3) the small size 403/kg (183/lb) of fish planted in Moose Lake (Bethers, 1975).

In 1975, new concrete weirs and gabion core dikes were built to replace original structures which were found to be inadequate during the first two years of fish rearing. This construction greatly reduced logistics of maintaining a poorly engineered facility and made available much more manpower for fish rearing activities.

During 1975, studies were designed to compare growth and survival of coho reared in Moose Lake with coho reared in fresh water pens, and to compare adult returns from pond reared smolts with returns from hatchery reared smolts imprinted to the Mendenhall Facility (Bethers, 1976). It was determined that fish growth in Moose Lake was greater than growth of fish reared in pens. However, total survival was greater in pens than in Moose Lake.

By 1976, it was suggested that perhaps Moose Lake could best be used for freshwater rearing of coho fry destined for the Fish Creek Saltwater Rearing Facility. By using Moose Lake as a freshwater "prepping" station for fish destined for the saltwater facility, it is believed that the maximum number of locally reared coho smolts could be released for the local fisheries. In 1976, 545,000 coho fry were planted in Moose Lake, with plans to transfer the fish to the saltwater facility for overwintering. In fall 1976, 99,439 coho in near smolt condition were transferred to the Fish Creek Facility for overwintering and spring release.

In 1977, one lot of coho smolts overwintered in salt water were transferred to the Mendenhall Facility to determine secondary imprinting characteristics of saltwater reared smolts. A lot of coho smolts reared in Moose Lake and a lot of hatchery reared smolts were also released to compare survival and adult returns of pond reared coho with that of hatchery reared coho imprinted to the facility.

Marked coho released from the Mendenhall Facility have been recovered in the Juneau area sport and commercial fisheries. Recovery data collected from 1975 through 1977 shows an estimated 422 Mendenhall reared coho taken by Juneau sport fishermen, and 2,880 taken by commercial trollers. Through 1977, a total of approximately 62 king salmon from smolt releases made in 1974 were taken by Juneau area sport fishermen.

Catch data collected on Mendenhall stock adult coho from 1975 and 1977 indicates that these fish entered the local Juneau area from August 20 to 26; during the peak of sport and commercial fishing activity. However, most recoveries were made during September by commercial trollers, after the peak of sport fishing activity.

The low contribution of artificially reared coho to the sport fishery might be due to the majority of Mendenhall stock coho returning to the Juneau area during the peak of commercial troll season and after the peak of the sport fishery. Also, because the Mendenhall stock is a short-run, late returning stock, a portion of the returning adults may enter the Juneau area in a "non-biting" condition which is common with coho prior to ascending spawning streams.

It was believed that we would have the greatest chance of improving the local sport fishery by developing a stock of coho that returns to the Juneau area early in the season and spends more time available to the Juneau area sport fishermen prior to August 15, the opening of the local commercial troll season.

It was decided that in 1977 this project would cease artificial rearing of the Mendenhall stock coho at the facility and would begin an evaluation of contribution to the local fisheries and timing through the Juneau area of 12 wild stocks of coho the Department has coded wire tagged. By comparing recovery dates of the 12 stocks in the Juneau area, the one that spends the most time available to the local fisheries could be selected for potential use at the rearing facility.

In 1977, this program inspected approximately 62,100 commercially caught coho and a sample of approximately 55% of the Juneau area troll catch was realized. A total of 71 individual coho from one wild stock (Auke Lake) were recovered from Mendenhall Lakes and Fish Creek rearing facilities. Data collected in 1977 indicated that Mendenhall stock coho released from the Mendenhall Facility was the earliest stock (of the three evaluated) to enter the Juneau area in numbers, and the Auke Lake stock was the latest.

Adult coho from all tagged wild stocks will be present in the fisheries in 1978, when comparable data on them will be collected.

RECOMMENDATIONS

Management

1. The most desirable stock of coho for use in improving the local sport fishery should be selected and a brood stock should be developed for use in local rearing facilities.

2. Contribution of the newly selected stock of coho to the Juneau area sport fishery should be determined through marine creel census programs, and to the commercial fishery by tag recovery programs.

3. The objective of the Mendenhall Project should be changed from producing salmon to improve the local sport fishery, to improving the local fisheries (sport and commercial).

4. The Mendenhall Facility should be used for the rearing of only coho salmon, and the rearing and/or release of spring king salmon should not be conducted in the future. The maintenance of two species at the facility causes much inefficiency in operation and undue stress on spawners during egg takes. The artificially reared king salmon cannot be properly fished by local sport fishermen because of local area closures necessary for the management and protection of local wild stocks of king salmon.

5. All rearing and brood stock maintenance related activities at the Mendenhall Facility should be conducted by the Division of Fisheries, Rehabilitation, Enhancement and Development.

Research

1. Evaluation of returns of coho and king salmon previously released from the facility should be continued.

2. The availability of returning adult coho to the local fisheries should be determined of smolts released into fresh water and smolts released into salt water.

3. Studies should be designed to determine techniques of maximizing returning adult coho availability and contribution to the local fisheries, i.e., time of release, saltwater imprint.

OBJECTIVES

1. Determine feasibility of increasing numbers of coho salmon available to the saltwater sport fishery in the Juneau area by pond rearing of salmon fry to smolt.

    a. Determine feasibility of improving smolt production by rearing of salmon from fry to smolt in pens in Moose Lake.

    b. Determine feasibility of increasing numbers of coho salmon available to the saltwater sport fishery by pond rearing coho fry during the summer and then transferring them to local estuarine rearing pens for overwintering and spring release.

2. Determine feasibility of imprinting and releasing hatchery reared king and coho salmon smolts at the Mendenhall Facility.

3. Establish a reliable source of Mendenhall stock king and coho spawn for future use at the facility.

4. Select and develop the most desirable brood stock of coho for use in improving the Juneau area marine sport fishery.

TECHNIQUES

The artificial rearing of salmon at the Mendenhall Facility began in summer of 1973. Prior to the planting of rearing fish, the out-migration of naturally produced coho was monitored and sampled for collection of length and age composition data. In May, 1973, the entire watershed was rehabilitated with Pro-Nox Fish brand of Rotenone.

In 1973, coho fingerling were planted in Norton and Dredge lakes and king fingerling in Moose Lake. From 1974 through 1976, Moose Lake was the only

lake used for artificial rearing and it was stocked annually with coho fingerling. In 1977, Moose and Dredge lakes were stocked with light densities of rearing coho for natural rearing.

All rearing fish planted at the facility from 1973 through 1976 were fed dry pellet feed during the summers and early fall. Fish were fed Oregon moist pellets medicated with 4.5 grams Oxytetracycline per 45 kg (100 pounds) for a two week period in the fall and from spring breakup until the out-migration period.

The amount of feed used on a given day was determined by the acceptance of feed by the fish. During each feeding, the fish were fed until the feeding response had nearly ceased. The amounts of feed used daily were recorded.

Rearing fish were sampled only periodically in 1973 and 1974; however, in 1975 and 1976, statistically sound sampling programs were used to determine fish growth in Moose Lake. In 1977, coho fry in Moose and Dredge lakes were not sampled for growth.

Arrangements were made with the Alaska Department of Fish and Game Pathology Lab in Anchorage, Alaska, to have samples of rearing fish inspected periodically or whenever a diseased fish was observed. Samples of rearing fish were collected and prepared according to methods dictated by the laboratory.

Rearing fish populations overwintered in the lakes from 1973 through 1976, were maintained by use of aeration systems designed by the Hinde Engineering Company, Highland Park, Illinois.

In spring 1974, traps were maintained in the outlets of the rearing lakes to capture out-migrant smolts as they left the lakes of their own volition. It soon became apparent that there was not sufficient outflow from the lakes to attract smolts and, subsequently, most smolts from Norton and Moose Lakes were seined from the lakes. Late in the summer of 1974, a 5,000 gallon per minute diesel powered pump was acquired to pump the level of the lakes down to a point at which all rearing fish could be removed by seining. This pump was used in annual smolt removal operations through spring, 1977.

In 1974, both king and coho reared at the facility were marked "adipose only" prior to release. Hatchery reared king smolts released from Mendenhall were marked "1/2 dorsal" at Crystal Lake Hatchery prior to shipment to Mendenhall. In 1975, coho reared in Moose Lake were marked "right ventral" prior to release. A lot of hatchery reared coho smolts were marked "adipose + coded wire tag" at Crystal Lake Hatchery prior to shipment to Mendenhall. Two unscheduled releases of hatchery reared coho smolt were made from the Mendenhall Facility in 1975. These smolts were marked "adipose + 1/2 dorsal" prior to shipment to Mendenhall.

Beginning in 1976, all lots of coho (hatchery reared included) were "adipose clipped and coded wire tagged" at Mendenhall prior to release. Subsequent released lots were treated and handled identically which provided much more comparable data.

In 1976, experiments were done in cooperation with the Fish Creek Estuarine Rearing Facility operated by the Division of Fisheries, Rehabilitation, Enhancement and Development near the mouth of the Mendenhall River. Coho smolts which had been pond reared at the Mendenhall Facility in the summer of 1976, were transferred to the estuarine rearing facility for overwintering and release in spring, 1977. A lot of coho smolts overwintered at the Fish Creek Facility were transferred back to the Mendenhall Facility in spring 1977, for secondary imprinting studies.

Contributions of the Mendenhall Facility to the sport and commercial fisheries was determined from data collected by two other State projects. Juneau creel census conducted under Sport Fish Harvest Studies was used to recover marked fish from the Juneau area saltwater sport catch. The Alaska Department of Fish and Game, Commercial Fisheries Tag Recovery Program, was used to recover marked fish from the Southeast Alaska commercial troll catch.

A small in-migrant trap was maintained in the outlet of the holding pond at the Mendenhall Facility to collect time of arrival data during normal water flows. Adult king and coho returning to the facility were enumerated as they were removed from the holding pond, either during egg takes or when found dead. All salmon removed from the pond were examined for finmarks. In December 1975, during a mid-winter thaw, several thousand coho returned to the facility. These fish were not allowed access to the holding pond because of heavy ice cover and were removed from the facility outlet. The lengths of adipose marked salmon recovered from the pond were recorded on tags which were attached to the fishes jaw. Heads were removed and taken to the Regional Fish and Game Lab for detection and removal of coded wire tags.

Spawner carcasses and fish in excess of spawning needs were disposed of at Juneau Cold Storage, at public fish give-aways, or were left along the outlet of the facility to replenish the nutrient cycle.

FINDINGS

Summaries of the number of coho and chinook stocked by year and their survival to smolt and adult are presented in Tables 1, 2 and 3.

Pond Rearing

Pond rearing activities began at the Mendenhall Facility in 1973 and have shown that king and coho salmon can be produced by pond rearing of fry to smolt.

Of 603,729 coho fry planted at the facility from 1973 to 1976, a total of 168,899 fish or 28.0% were released from the lakes, and fry to smolt production was 124,023 smolts or 20.5%.

Total survival of individual lots of coho ranged from 6.0% to 67.0% and fry to smolt production from 49.4% to 1.1%.

Table 1. Summary of salmon fry planted, total fish survival in lakes, and fry to smolt production at the Mendenhall Rearing Facility from 1973, through 1977.

Brood & Species		Lot	No. Fry Stocked	Size at Plant	Plant Date	Release Date	Total Survival	Percent Survival	No. Smolts	Size at Release	% Fry to Smolt
1972	Coho	Norton L.	120,848		8/73	7/74	80,960	67.0	54,990		45.5
		Dredge L.	138,896		8/73	6/74	35,555	25.6	26,435		19.0
		Total	259,744	576/kg.			116,515	44.9	81,425	136/kg.	31.3
1972	King	Moose L.	155,078	73/kg.	9/73	6/74	95,731	61.7	93,731	60/kg.	60.4
1973	Coho	Moose L.	209,485	279/kg.	9/74	5/75	12,432	6.0	3,904	161/kg.	1.8
1974	Coho	Moose L.	134,500	660/kg.	6/75	5/76	39,952	29.7	38,694	53/kg.	28.8
		North Pen	10,000	660/kg.	6/75	5/76	5,080	50.8	4,233	90/kg.	42.3
		South Pen	5,000	660/kg.	6/75	4/76	3,071	61.4	2,470	71/kg.	49.4
		Total	149,500				48,103	32.2	45,397		30.3
1975	Coho	Moose L.	545,000	992/kg.	6/76	9/76	99,439	18.2	99,439	66/kg.	18.2
						4/77	10,095	1.9	6,197	59/kg.	1.1
		Total					109,534	20.1	105,636		19.4
1976	Coho	Moose L.	15,272	495/kg.	5/77	(Not Released at Time of Report)					
		Dredge L.	11,095	495/kg.	5/77						
		Total	26,367	495/kg.							

Table 2. Summary of salmon smolts released, marks used and percent marked of smolts released from Mendenhall Lakes Rearing Facility, 1973, through 1977 (includes Crystal Lake Hatchery and Fish Creek Estuarine Reared Smolts released from Mendenhall).

Brood	Species	Lot	Release Date	No. Smolts Released	Size at Release	Number Marked	Percent Marked	Mark Used
1972	Coho	Norton L.	7/74	54,990				
		Dredge L.	6/74	26,435				
		Total		81,425	136/kg.	24,835	30.5	Adipose
1972	King	Moose L.	6/74	93,129	73/kg.	39,560	42.4	Adipose
	King	C.L. Hatchery	6/74	124,309	29/kg.	124,309	100.0	1/2 Dorsal
		Total		217,438		163,869	75.4	
1973	Coho	Moose Lake	5/75	3,904	161/kg.	1,296	33.2	R.V.
		C.L. Hatchery	6/75	50,200	31/kg.	15,200	30.2	Ad + CWT 4-2-6
		C.L. Hatchery	6/75	46,479	31/kg.	46,479	100.0	Ad + 1/2 Dorsal
		Total		100,583		62,975	62.6	
1974	Coho	Moose Lake	5/76	38,694	53/kg.	14,180	36.6	Ad + CWT 4-4-2
		North Pen	5/76	4,233	90/kg.	4,233	100.0	Ad + CWT 4-4-4
		South Pen	4/76	2,430	70/kg.	2,430	100.0	Ad + CWT 4-4-3
		C.L. Hatchery	6/76	42,231	42/kg.	14,695	34.8	Ad + CWT 4-4-14
		Total		87,588		35,538	40.5	
1975	Coho	Moose Lake	4/77	6,197	59/kg.	6,197	100.0	Ad + CWT 4-16-42
		C.L. Hatchery	5/77	22,816	46/kg.	22,816	100.0	Ad + CWT 4-16-40
		Fish Cr. E.R.F.	4/77	10,097	68/kg.	10,097	100.0	Ad + CWT 4-2-7
		Total		39,110		39,110	100.0	
1975	Coho*	Moose Lake	9/76	99,439	66/kg	Transferred to Fish Creek E.R.F. for wintering and spring release into saltwater.		
		Fish Creek (1)	4/77	10,731	43/kg.	10,349	96.4	Ad + CWT 4-16-4
		Fish Creek (2)	5/77	7,600	25/kg.	7,486	98.5	Ad + CWT 4-16-51
		Fish Creek (3)	5/77	6,155	45/kg.	5,798	94.5	Ad + CWT 4-16-5
		Fish Creek (4)	5/77	10,648	41/kg.	10,350	97.2	Ad + CWT 4-16-6
		Fish Creek (5)	5/77	8,432	40/kg.	8,381	99.4	Ad + CWT 4-16-39
		Total		43,566		42,364	97.2	

* Additional fish from this culture treatment released unmarked.

Table 3. Expanded Returns of Coho Salmon Reared at and/or Released from Mendenhall Lakes.

RELEASE						RETURNS											
						Jack					Adults						
						Sport		Commercial			Sport		Commercial				
Brood Year	Lot	Mark	Number Released	Number Marked	Marked %	C.C.	Reports	Sample	Reports	ESC to Facil.	C.C.	Reports	Sample	Reports	ESC to Facil.	Total	
			(1974)							(1974)	(1975)						%
1972	Norton Lake Dredge Lake	Adipose only	81,425	24,835	30.5	0	0	0	0	614	333	0	901	0	6,774	8,622	10.6
			(1975)							(1975)	(1976)						
1973	Moose Lake	R.V.	3,904	1,296	33.2	0	4	0	0	39	0	0	0	0	---		
	C.L. Hatchery	Ad + 4/2/6	50,200	15,200	30.3	0	18	0	0	548	89	1	1,064	0	---		
	C.L. Hatchery	Ad + 1/2 D	46,479	46,479	100.0	0	9	0	0	114	0	0	0	0	---		
	Total		100,583	62,975	62.6	0	31	0	0	701	89	1	1,064	0	3,501	5,387	5.4
			(1976)							(1976)	(1977)						
1974	Moose Lake	Ad + 4/4/2	38,694	14,180	36.6	0	0	0	0	253	0	2	658	0	575	1,488	3.8
	North Pen	Ad + 4/4/4	4,233	4,233	100.0	0	0	0	0	3	0	0	10	0	12	25	.6
	South Pen	Ad + 4/4/3	2,430	2,430	100.0	0	0	0	0	0	0	0	13	0	8	21	.9
	C.L. Hatchery	Ad + 4/4/14	42,231	14,695	34.8	0	0	0	0	141	0	0	150	0	21	312	.7
	Total		93,588	35,538	38.0	0	0	0	0	397 719*	0	2	831	0	616	1,846	2.0
																2,168	2.3
			(1977)							(1977)	(1978)						
1975	Moose Lake	Ad + 4/16/42	6,197	6,197	100.0	0	1	0	0	65							
	C.L. Hatchery	Ad + 4/16/40	22,816	22,816	100.0	0	0	3	0	40							
	Fish Cr. ERF	Ad + 4/2/7	10,097	10,097	100.0	0	1	0	0	22							
	Total		39,110	39,110	100.0	0	2	3	0	127							
	Moose Lake	Pond Reared in Moose Lake 4/76 - 9/76 then Transferred to Fish Creek Estuarine Rearing Facility for Overwintering and Spring Release #99,439															
	Released from Fish Creek		(1977)							(1977)	(1978)						
	(1)	Ad + 4/16/4	10,731	10,349	96.4	0	1	10	0	6							
	(2)	Ad + 4/16/51	7,600	7,486	98.5	0	1	28	0	7							
	(3)	Ad + 4/16/15	6,155	5,798	94.2	0	1	0	0	1							
	(4)	Ad + 4/16/6	10,648	10,350	97.2	1	1	8	1	5							
	(5)	Ad + 4/16/39	8,432	8,381	99.4	0	1	3	1	2							
	Total		43,566	42,364	95.2	1	5	49	2	21							

*Unmarked Jacks Included

C.C.: Creel Census

Of a single lot of spring king salmon pond reared in Moose Lake in 1973, total survival was 95,731/155,078 or 61.7%. Smolts were produced from 93,731 or 60.4% of the fry planted.

Fresh Water Pen Rearing

Two lots of 1974 brood coho were reared in net pens within Moose Lake from 1975 to 1976 to determine feasibility of pen culture in freshwater lakes. One rearing pen was stocked with 5,000 coho fry and the other with 10,000 coho fry. Moose Lake and the two rearing pens were stocked on June 24, with Mendenhall/Blind Slough stock coho which averaged 661/kg at planting. Length and weight data were collected on fish in rearing pens and free-ranging fish in Moose Lake so that a comparison of the culture treatments could be made.

It was determined that survival of pen reared coho was greater than that of pond reared coho; however, the average size of pond reared fish was greater than that of pen reared fish. A comparison of survival from planting to release, average fork length and number per kilogram of pond reared and pen reared coho smolts follows:

	Moose Lake	North Pen	South Pen
No. planted (661/kg, 300/lb)	139,500	10,000	5,000
Total Survival	39,952 (28.6%)	5,080 (50.8%)	3,071 (61.4%)
Smolts released/plant	38,694 (27.7%)	4,233 (42.3%)	2,470 (49.4%)
Average No./kg, (lb)	52.9 (24)	90.4 (41)	70.5 (32)
Average Fork Length	141.0 mm	111.8 mm	111.4 mm

Freshwater Pond Rearing, Saltwater Release:

In 1976, studies were begun to determine feasibility of increasing numbers of coho available to the local fisheries by using the Mendenhall Facility as a summer "prepping" station for large numbers of coho destined for overwintering and release from the Fish Creek Estuarine Rearing Facility.

A total of 545,000 coho fry at 992/kg (450/lb) were planted in Moose Lake on June 7, 1976. On September 18, a total of 99,439 coho at 66/kg (30/lb) in "near smolt" condition were transferred from Moose Lake to the Fish Creek Facility for overwintering and spring release. Of the 99,439 coho transferred to the Fish Creek Facility in fall, 1976, a total survival through spring 1977, of 72,895 smolts was realized. A total of 62,798 of these smolts were released for the fisheries and 10,097 were transferred back to the Mendenhall Facility for release in secondary imprinting studies.

Coho Returns:

Coho salmon from artificially reared smolts released at Mendenhall have contributed to the sport and commercial fisheries since 1975.

From 1975 through 1977, a total of 16,177 coho returned from 275,576 smolts pond reared at Mendenhall Lakes and from Crystal Lake Hatchery

reared smolts released from the Mendenhall Facility. A summary of total coho returns through 1977 is presented below:

Brood Year	Jack Escapement	Sport Catch Jack + Adult	Commercial Catch	Adult Escapement	Total Return
1972	614	333	901	6,774	8,622
1973	701	121	1,064	3,501	5,387
1974	719	2	831	616	2,168
Total	2,034	456	2,796	10,891	16,177

Individual release lots were evaluated and compared by the percent of marked fish (number returning/number marked) returning per lot (Table 4). To date, complete return data have been collected on three life cycles of coho released from the Mendenhall Facility.

Experiments the past three years have shown that adult coho from pond reared smolts returned at an average marked fish return rate of 2.67% compared to .48% for freshwater pen reared smolts and .80% for hatchery reared smolts released from the facility. In 1977, marked jack coho from pond reared smolts returned at a rate of 1.14% compared to .57% for hatchery reared smolts and .045% for freshwater pen reared smolts.

In both jack and adult coho returns in 1976 and 1977, the percent of marked fish returning to the facility was less than the percent of marked smolts released:

Year	Percent Smolts Marked	Percent Returns Marked
1976	62.0	10.0
1977	37.7	16.9

Apparently, marked smolts suffered a considerably higher mortality after release than did non-marked smolts. In 1976, approximately 46% of the smolts released carried double fin marks (adipose + 1/2 dorsal). Perhaps this double mark was responsible for heavy mortality of released smolts and for poor returns from this lot.

A comparison of marked coho returns from pond reared smolts, freshwater pen reared smolts and hatchery reared smolts released from the Mendenhall Facility is presented in Table 5.

Jack return data of 1975 brood coho released from Mendenhall from which adults will return in 1978 is presented below:

Lot	No. Marks Released	Jack Return 1977	Percent
Moose Lake	6,197	65	1.05
C.L. Hatchery	22,816	40	.175
Fish Cr. E.R.F.	10,097	22	.218

Table 4. Returns of (Marked) Coho Salmon Reared at and/or Released from Mendenhall Lakes.

RELEASE						RETURNS											
						Jack					Adults						
						Sport		Commercial			Sport		Commercial				
Brood Year	Lot	Mark	Number Released	Number Marked	% Marked	C.C.	Reports	Sample	Reports	ESC to Facil.	C.C.	Reports	Sample	Reports	ESC to Facil.	Total	%
			(1974)							(1974)	(1975)						
1972	Norton Lake Dredge Lake	Adipose only	81,425	24,835	30.5	0	0	0	0	187	108	0	175	0	207*	677	2.7
			(1975)							(1975)	(1976)						
1973	Moose Lake	R.V.	3,904	1,296	33.2	0	4	0	0	11	0	0	0	0	58	73	5.6
	C.L. Hatchery	Ad + 4/2/6	50,200	15,200	30.2	0	18	0	0	153	1	1	33	0	52	258	1.7
	C.L. Hatchery	Ad 1/2 D	46,479	46,479	100.0	0	9	0	0	114	0	0	0	0	74	197	.4
	Total		100,583	62,975	62.6	0	31	0	0	278	1	1	33	0	184	528	.6
			(1976)							(1976)	(1977)						
1974	Moose Lake	Ad + 4/4/2	38,694	14,180	36.6	0	0	0	0	253	0	2	43	0	81	379	2.8
	North Pen	Ad + 4/4/4	4,233	4,233	100.0	0	0	0	0	3	0	0	4	0	12	19	.4
	South Pen	Ad + 4/4/3	2,430	2,430	100.0	0	0	0	0	0	0	0	5	0	8	13	.5
	C.L. Hatchery	Ad + 4/4/14	42,231	14,695	34.8	0	0	0	0	141	0	0	10	0	3	154	1.0
	Total		93,588	34,538	38.0	0	0	0	0	397	0	2	62	0	104	565	1.6
			(1977)							(1977)	(1978)						
1975	Moose Lake	Ad + 4/16/42	6,197	6,197	100.0	0	1	0	0	65							
	C.L. Hatchery	Ad + 4/16/40	22,816	22,816	100.0	0	0	1	0	40							
	Fish Cr. ERF	Ad + 4/2/7	10,097	10,097	100.0	0	1	0	0	22							
	Total		39,110	39,110	100.0	0	2	1	0	127							
Moose Lake Pond Reared in Moose Lake 4/76 - 9/76 then Transferred to Fish Creek Estuarine Rearing Facility for Overwintering and Spring Release #99,439																	
Release from Fish Creek (1977)										(1977)	(1978)						
	(1)	Ad + 4/16/4	10,731	10,349	96.4	0	1	4	0	6							
	(2)	Ad + 4/16/51	7,600	7,486	98.5	0	1	11	0	7							
	(3)	Ad + 4/16/5	6,155	5,798	94.5	0	1	0	0	1							
	(4)	Ad + 4/16/6	10,648	10,350	97.2	1	1	3	1	5							
	(5)	Ad + 4/16/39	8,432	8,381	99.4	0	1	1	1	2							
		Total	43,566	42,364	97.2	1	5	19	2	21							

C.C.: Creel Census

Table 5. Total return of marked coho from pond reared smolts, freshwater pen reared smolts and hatchery reared smolts released from the Mendenhall Facility, 1973-1975.

Brood	Marked Fish Released	Jack Return	Sport Catch	Comm. Catch	Adult Escapement	Total Return	Percent
POND REARED SMOLTS:							
1972	24,385	187*	108	175	207*	677	2.78
1973	1,296	15	0	?	58	73	5.63
1974	14,180	253	2	43	81	379	2.67
Total	39,861	455 (1.14%)	110	218	346	1,129	2.83
FRESHWATER PEN REARED SMOLTS:							
1973 (1)	4,233	3	0	4	12	19	0.45
(2)	2,430	0	0	5	8	13	0.53
Total	6,663	3 (.045%)	0	9	20	32	0.48%
HATCHERY REARED SMOLTS:							
1973 (1)	15,200	171	2	33	52	258	1.70
(2)	46,479	123	0	0	74	197	0.42
1974	14,695	141	0	10	3	154	1.05
Total	76,374	435 (0.57%)	2	43	129	609	0.80

* 1972 number of marks in jack return and in escapement estimated from marked; un-marked ratio of smolts released.

Contribution to the fisheries was determined for coho which were pond reared during the summer and then transferred to Fish Creek Estuarine Rearing Facility for overwintering and spring release. Of 42,364 marked smolts released, six were recovered as jacks in the Juneau area sport fishery in 1977, 61 in the commercial troll fishery, and 21 returned to the Mendenhall Facility.

Locations and catch dates of Mendenhall Lakes released tagged coho taken by commercial trollers in 1976 and 1977 are presented in Figure 1. Locations of marked coho taken in the Juneau area are presented in Figure 2.

Note that Figures 1 and 2 present a distribution of recovery and not a distribution of marked fish. Had all waters received equal fishing pressure, the distribution of recovery may have been different. Also, in Figure 1, the large number of recoveries in Districts 111 and 112 in 1977 is due in part to a greater sampling intensity.

Spring King Salmon Returns:

The first returns of spring king salmon to the Mendenhall Facility from smolts released in 1974 were in 1976. Adult king returns from these releases should continue through 1978.

During 1976, an estimated 257 age 1.2 kings returned to the Juneau area from the 1974 releases. Included were 40 fish taken by Juneau area sport fishermen from May 23 to July 11, 1976 (Robards, 1977). Of these, 32 fish or 80% were from smolts reared in Moose Lake, and eight fish or 20% were from hatchery reared smolts released from the facility (Table 6).

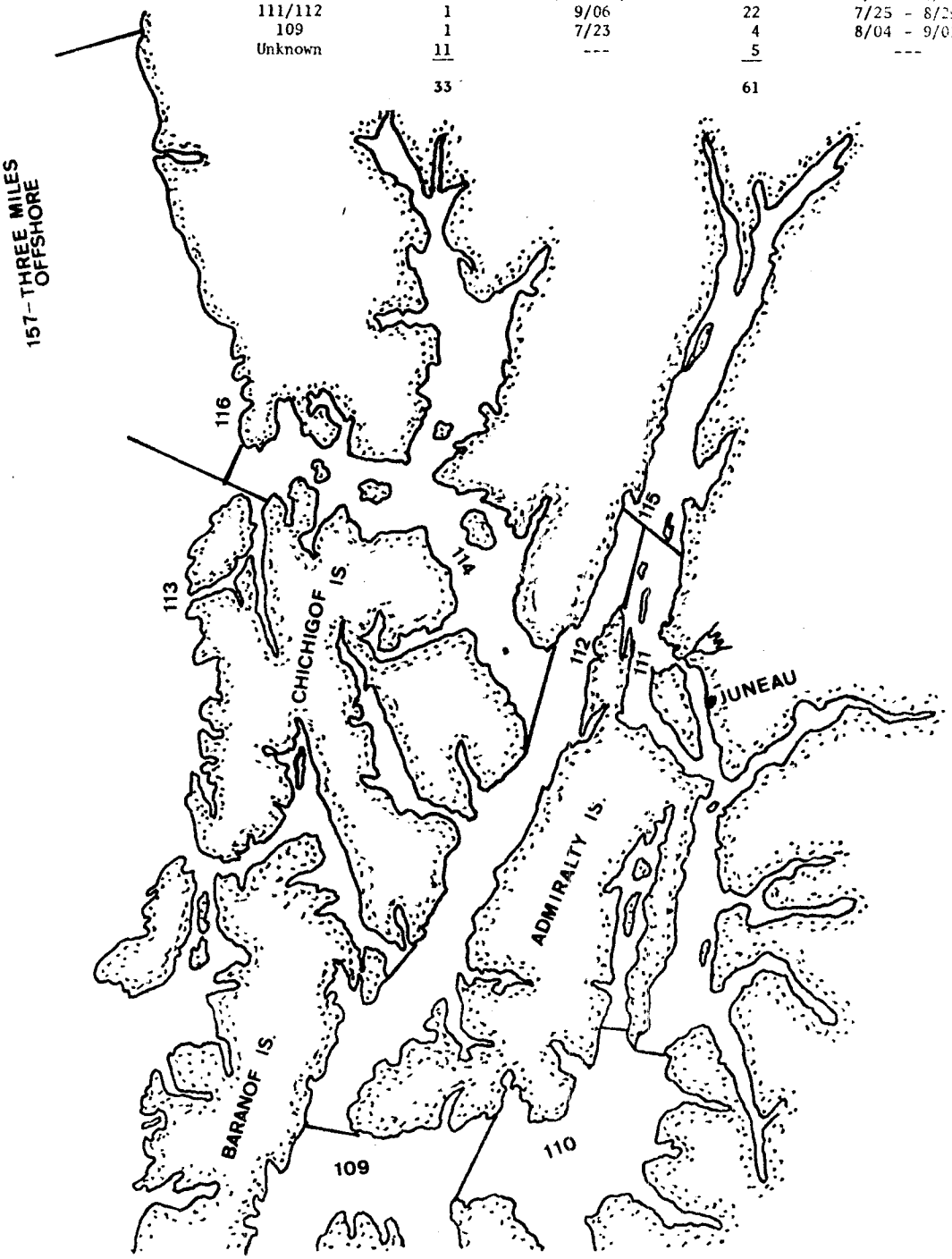
Locations and catch dates of Mendenhall released king salmon taken by Juneau area sport fishermen in 1976 and 1977 are presented in Figure 3. (Figure 3 includes eight kings reported by anglers which are considered to be included in the estimated sport catch.) Most recoveries of marked kings were made in the Tee Harbor and Breadline areas which also received the greatest fishing pressure by spring king fishermen in the Juneau area..

An estimated total of 861 age 1.3 spring king salmon from smolts released from the Mendenhall Facility returned to the Juneau area in 1977. Included were 22 fish taken by the Juneau area sport fishermen from May 15 to June 30, 1977. Of these, 12 fish or 54.5% were from smolts reared in Moose Lake, and 10 fish or 45.5% were from hatchery reared smolts released from Mendenhall (Robards, 1978).

In 1976, a total of 158 adult kings from pond reared smolts returned to the Mendenhall Facility, compared to a return of 66 from hatchery reared smolts. In 1977, 404 returned from pond reared smolts compared to 107 from hatchery reared smolts released from the facility.

Figure 1. Locations and catch dates of Mendenhall Lakes marked adult coho taken in the commercial troll fishery. 1976 and 1977.

Commercial District	1976 Marked Fish Recovered	1976 Recovery Dates	1977 Marked Fish Recovered	1977 Recovery Dates
157	5	8/09 - 9/03	3	7/25 - 8/22
116	3	8/12 - 8/24	13	7/28 - 8/29
113	8	8/10 - 9/10	9	7/28 - 9/16
114	4	9/04 - 9/13	5	7/31 - 8/26
111/112	1	9/06	22	7/25 - 8/29
109	1	7/23	4	8/04 - 9/01
Unknown	11	---	5	---
	33		61	



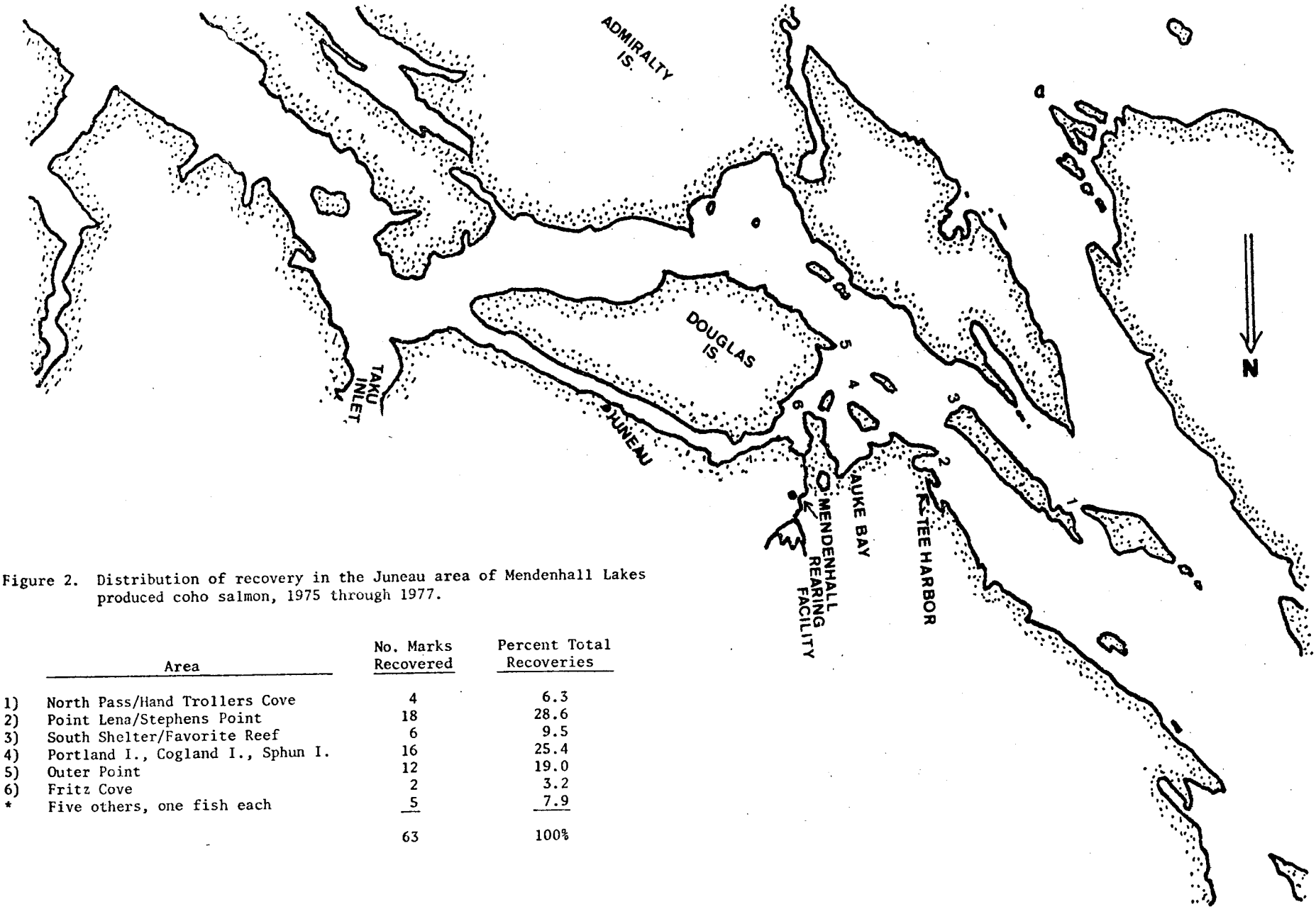


Figure 2. Distribution of recovery in the Juneau area of Mendenhall Lakes produced coho salmon, 1975 through 1977.

	Area	No. Marks Recovered	Percent Total Recoveries
1)	North Pass/Hand Trollers Cove	4	6.3
2)	Point Lena/Stephens Point	18	28.6
3)	South Shelter/Favorite Reef	6	9.5
4)	Portland I., Cogland I., Sphun I.	16	25.4
5)	Outer Point	12	19.0
6)	Fritz Cove	2	3.2
*	Five others, one fish each	5	7.9
		63	100%

Table 6. Release and return data collected through 1977 on two lots of 1972 brood spring king salmon released from the Mendenhall Facility in spring 1974.

Brood Year	Lot	Date Released	Number Released	Number Marked	Year	Catch		Escapement To Facility	Return Per Year	Accum. Return	Accum. Percent Return
						Sport	Comm.				
'72	A.	06/74	93,129	39,560	'74	0	0	4	4	4	0.00
					'75	0	0	0	0	4	0.00
(Hatched at Crystal Lake Hatchery reared to smolt at Moose Lake. Marked Adipose clip).					'76	32	?	126	158	162	.17
					'77	12	?	392	404	566	.60
					'78	x	?	x	x	x	x
				Total		44	?	522	566	728	
'72	B.	06/74	124,309	124,309	'74	0	0	11	11	11	0.00
					'75	0	0	0	0	11	0.00
(Hatched at Crystal Lake Hatchery reared to smolt at hatchery released as smolt from Mendenhall Facility. Marked with 1/2 Dorsal Clip).					'76	8	?	58	66	77	.06
					'77	10	?	97	107	184	.13
					'78	x	?	x	x	x	x
				Total		18	?	166	184	261	

x = Fish have not returned @ time of report.
1976 33 "strays" counted in Mendenhall River tributaries not included in table
1977 348 "strays" estimated in Mendenhall River tributaries and two counted in Auke Creek not included in table.

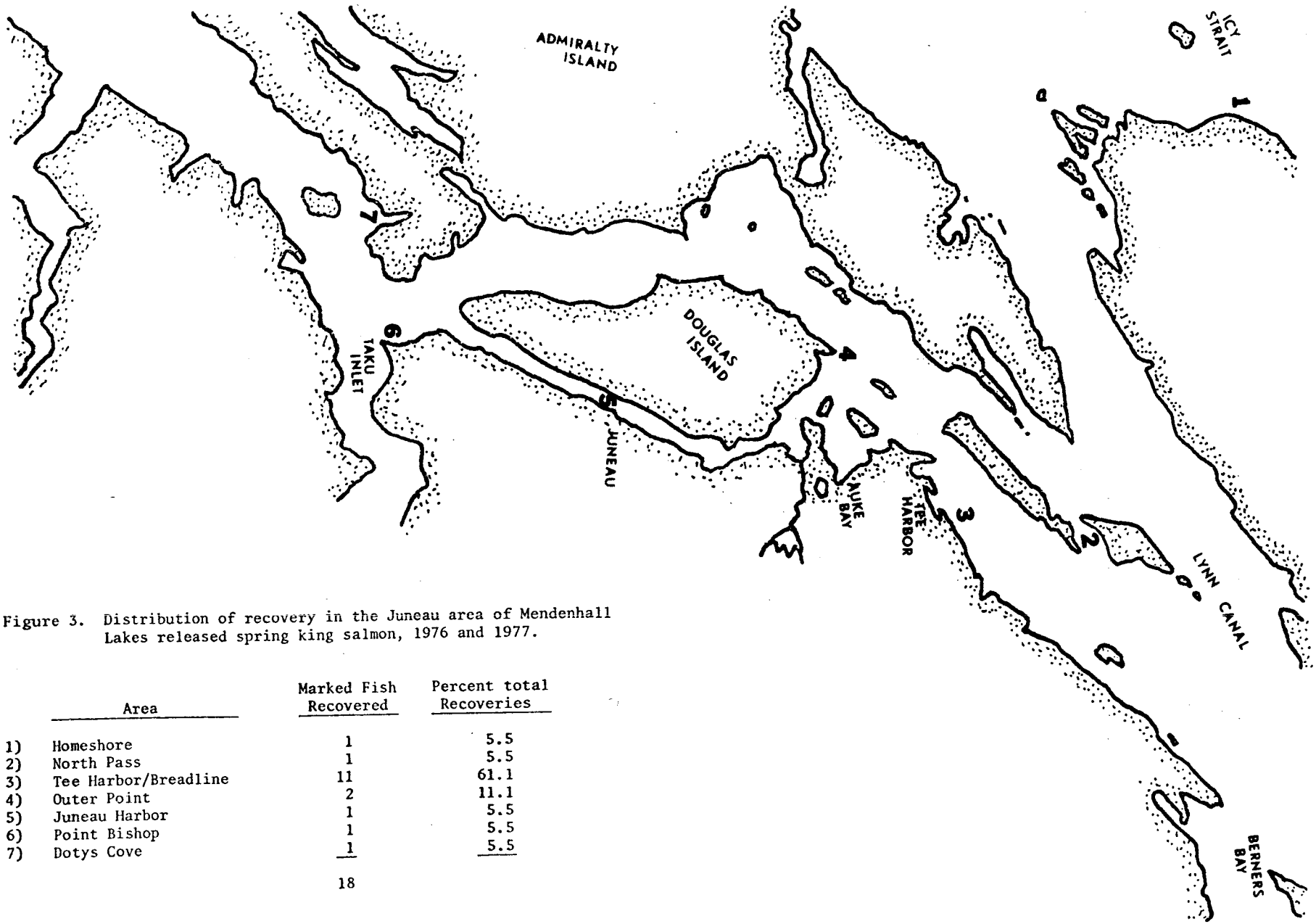


Figure 3. Distribution of recovery in the Juneau area of Mendenhall Lakes released spring king salmon, 1976 and 1977.

	Area	Marked Fish Recovered	Percent total Recoveries
1)	Homeshore	1	5.5
2)	North Pass	1	5.5
3)	Tee Harbor/Breadline	11	61.1
4)	Outer Point	2	11.1
5)	Juneau Harbor	1	5.5
6)	Point Bishop	1	5.5
7)	Dotys Cove	1	5.5
		18	

Considerable straying of adult king salmon was realized as in 1976; 33 kings were surveyed in Montana, McGinnis and Steep creeks. In 1977, 350 fish were found to have strayed from the facility.

Brood Stock Development:

Returning adult coho from smolts released at the Mendenhall Facility has provided eggs for future use at Mendenhall and other facilities since 1975. The numbers of coho eggs taken annually at the facility since 1975 are:

1975	1,100,000
1976	1,008,000
1977	950,000

Since 1976, king salmon returning to the Mendenhall Facility have provided for an easy source of eggs for future use at rearing facilities. However, this source will not be available after 1978, as smolts were released in only 1973. During 1976, a total of 225,000 king eggs were taken, and 560,000 in 1977.

Coho Stock Selection:

A total of 71 adult coho with coded wire tags were recovered in the Juneau area in 1977. Of those recovered 21 were of Auke Lake stock, 18 were of Mendenhall stock, 26 were of Blind Slough stock released from Fish Creek Estuarine Rearing Facility, and six were of Blind Slough stock released from Mendenhall.

The Mendenhall stock appeared to arrive and peak somewhat earlier than the other stocks evaluated. However, there appeared to be little difference in time of arrival and peak of recovery in the Juneau area of the three stocks evaluated.

Recovery data collected on Mendenhall, Auke Lake and Blind Slough stocks of coho in the Juneau area in 1977 is presented below:

Stock	Number Released	Number Recovered	First Recovery	Peak of Recovery	Last Recovery
Mendenhall	20,843	18	7/25	8/28	9/17
Auke Lake	2,992	21	7/30	9/05	9/16
Blind Slough from Fish Creek	43,632	26	8/01	8/31	9/14
Blind Slough	14,695	6	8/22	9/05	9/13

Recovery locations made in the Juneau area are presented in Figure 4.

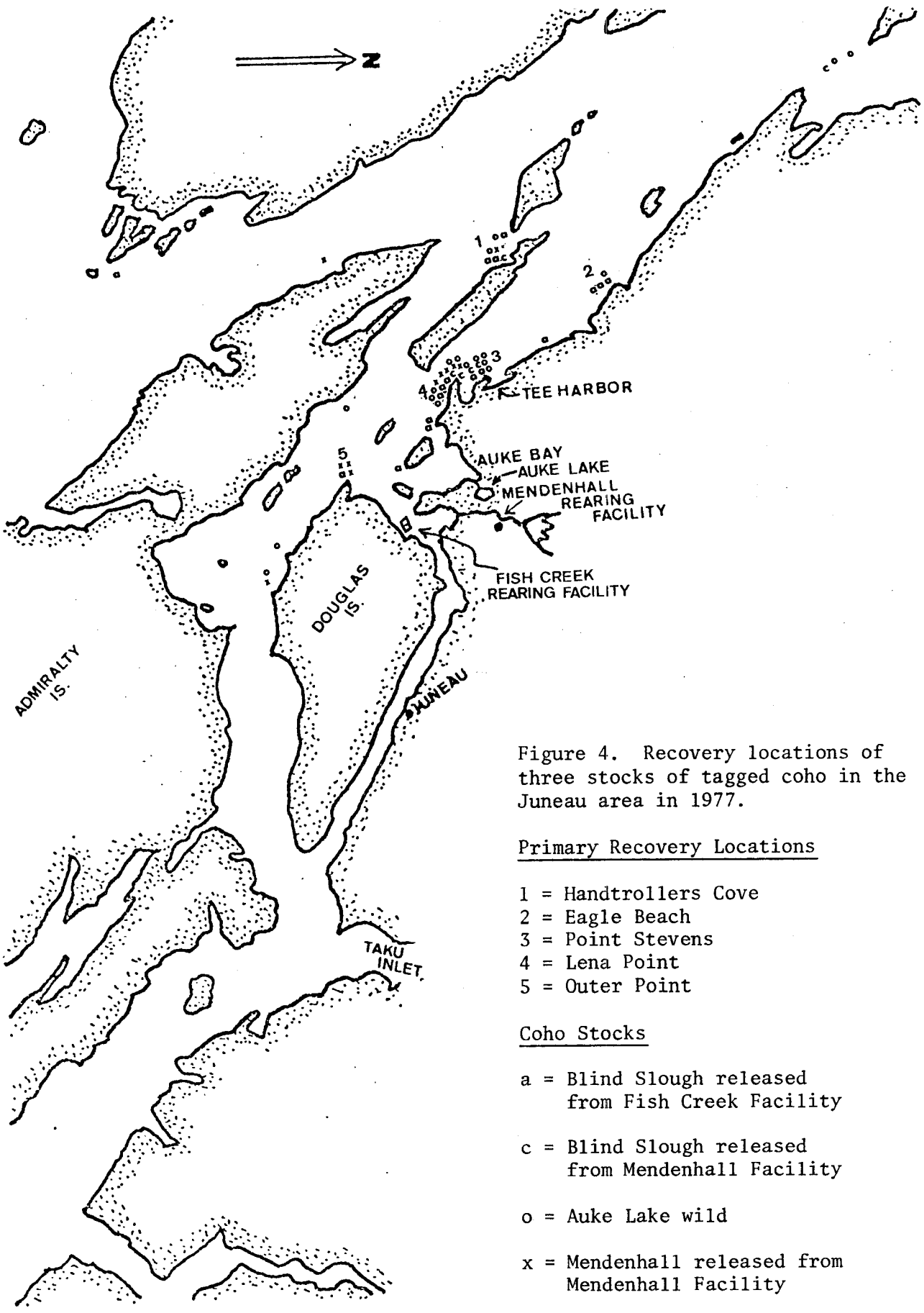


Figure 4. Recovery locations of three stocks of tagged coho in the Juneau area in 1977.

Primary Recovery Locations

1 = Handtrollers Cove
2 = Eagle Beach
3 = Point Stevens
4 = Lena Point
5 = Outer Point

Coho Stocks

a = Blind Slough released from Fish Creek Facility

c = Blind Slough released from Mendenhall Facility

o = Auke Lake wild

x = Mendenhall released from Mendenhall Facility

DISCUSSION

Pond Rearing:

We feel it is feasible to raise a limited number of salmon smolts by pond rearing techniques at the Mendenhall Facility as the majority of fish removed from the rearing lakes at the end of each rearing cycle have been smolts. It is realized that the maximum capacity of Moose Lake is ultimately regulated by the amount of water circulation through the lake on an annual basis. The maximum number of smolts that can be produced in Moose Lake has not been determined; however, a sustained annual production of approximately 100,000 smolts would probably be realistic.

Factors limiting smolt production at the Mendenhall Facility have included: (1) washouts of Dredge and Moose lakes, (2) periodic heavy predation by common mergansers and Arctic terns and some predation by larger rearing fish on smaller fish, and (3) mortality due to stress related diseases.

Bacterial kidney disease was discovered in rearing fish in Moose Lake in 1976. I feel because of the presence of such diseases, it might be beneficial to drain Moose Lake periodically and remove built-up organic matter from the bottom, thereby "cleaning" the rearing environment.

I feel with an extensive staff of fish culturists, pathologists and support that the production of Moose Lake might be considerably greater than we have experienced to date.

Freshwater Pen Rearing:

Total fish survival and production of smolts in the net pens was higher than that of free-ranging coho in Moose Lake. The greater percent of sub-smolts released from the pens indicates that the pens offered some protection to rearing fish. The smaller size of pen reared smolts compared to pond reared is probably due to the lack of natural feed in the rearing pens.

Much manpower was required to maintain clean net pens in Moose Lake during the the warm summer months. Also, Moose Lake has a maximum depth of 11 feet as compared to eight feet required by the rearing pens. The bottom of the rearing pens were in, or very close to, the organic benthos of Moose Lake where fish waste and waste food accumulate and decompose. The potential for disease was extreme. Because of the limited water flow of Moose Lake, maintenance required and potential of disease, the use of rearing pens in Moose Lake is not considered to be feasible.

Freshwater Pond Rearing, Saltwater Release:

This cooperative culture treatment was successful in providing 62,798 coho smolts for the fishery. This treatment will not be completely evaluated until 1978, when adults from this culture treatment return. Jack returns indicate that pond reared smolts released into salt water contribute well to the fisheries. Because the smolts released into salt water are not "imprinted" to a fresh water source. They might tend to "mill around" more in fishing areas and be more available to fishermen. This will be evaluated further in 1978.

It is seriously doubted that Moose Lake could annually produce more than 100,000 smolts for the Fish Creek Facility and maintain sufficient smolt releases for broodstock maintenance at Mendenhall.

The contribution to the fisheries in 1978 of the pond reared, saltwater released coho could be very important in determining future use of the Mendenhall Facility. If contribution of these fish to the fishery is high, it might be feasible in the future to use Moose Lake exclusively as a "prepping station" for coho destined for the saltwater facility.

Coho Returns:

Although considerable annual variation in percent return of coho has been observed, the average marked fish rate of return has been 2.83% for pond reared smolts compared to .48% for freshwater pen reared smolts and .80% for hatchery reared smolts released from the facility.

The differences in rate of return between pond reared and hatchery reared coho smolt is believed to be due to differences in rearing habitat. One could assume that survival after release of smolts reared in a "semi-wild" lake environment would be greater than that of smolts reared in the protection of an artificial hatchery raceway. I feel that hatchery reared smolts are less able to adapt to the wild environment than pond reared smolts, and suffer considerably greater mortality due to predation after release.

The contributions of hatchery reared smolts to the fisheries have been consistently lower than that of pond reared smolts. Because of this I feel the hatchery reared smolts suffer a much greater mortality probably at entry to salt water.

In 1976 and 1977, the percent of marked coho returning to the Mendenhall Facility was much less than the percent of marked smolts released. I feel a higher mortality rate of marked fish is responsible and is perhaps affected by the 1^{o}-3^{o}C glacial Mendenhall River through which smolts out-migrate.

It should be noted that catch location data presented in the figures for both coho and king salmon are actual distributions of recoveries and not distributions of marked fish. All areas of major recovery for both coho and king salmon are areas receiving the greatest fishing pressure. Had all available water received equal fishing pressure, the distribution of catch may have been different.

Spring King Salmon:

Data collected on catch and escapement during 1976 and 1977 indicate that (as in coho) hatchery reared king smolts return at a fraction of the return rate of pond reared smolts. The difference in return between pond reared and hatchery reared smolts is probably related to the different rearing environments. One might assume that the Moose Lake reared smolts, being raised in a "semi-wild" environment, would be more capable of survival in the marine environment than smolts reared in artificial hatchery conditions. Also, some hatchery reared smolts may have imprinted on Crystal Lake Hatchery

water prior to transfer to the Mendenhall Facility for release. The tendency of king smolts released at Mendenhall to stray back to Crystal Lake Hatchery could not be evaluated because smolts released from the hatchery carried the same fin marks as hatchery reared smolts released from Mendenhall.

Straying of king salmon in 1977 was believed to be due in part to extremely low water levels at the facility in late summer 1977. During some periods there wasn't sufficient water in the outlet channel for a king salmon to get into the holding pond.

Some kings were attracted into the weir by releasing water stored in Moose and Dredge lakes down the outlet. Approximately 116 kings were seined from the facility outlet, carried over the weir and released in the holding pond during periods of extremely low water.

After two years of king salmon returns to the Mendenhall Facility, I have concluded that the facility, in its present status, is not an ideal location for releasing spring king salmon. The primary reason being the lack of water flow from the facility during the summer months when adult spring kings are returning. I feel this has been the major cause of fish straying from the facility and into other tributaries of the Mendenhall River. The outflow from the Mendenhall Facility during the summer is only a fraction of the flow in any of the three tributaries where stray kings were observed.

I feel there would have been a much better return of kings to the facility if the facility had more attraction water for returning kings than other tributaries of the system and if the facility outlet was unobstructed and always contained a sufficient amount of water for fish to enter the holding pond of their own volition.

The feasibility of maintaining both king and coho brood stocks at the facility in its current status is questionable because of excessive fish handling required when ripening two species of spawners in the same holding pond at the same time.

Holding two species together has caused much sorting and handling of "green" fish of both species when collecting ripe fish for egg takes. Excessive handling of spawners has been a major cause of mortality and Saprolegnia infection among spawners in the pond.

Much greater returns of both king and coho to the fisheries and facility have been from pond reared smolts, as compared to smolts raised elsewhere and released from the Mendenhall Facility. Since pond reared smolts are apparently much more viable than hatchery reared smolts, one could conclude that pond rearing is the better of two methods available for producing smolts for the local fisheries. In consideration of the low returns from hatchery reared smolts I feel it would be feasible only to release such smolts for maintenance of a brood stock at Mendenhall Lakes. Maintenance of a brood stock at Mendenhall by release of hatchery reared smolts will require sizeable releases of smolts and for best returns to the facility marking or tagging is not recommended.

In consideration of the logistics, manpower and support required to transport smolts from the hatchery to Mendenhall for release and the subsequent low returns experienced to date, it is not considered effective nor feasible to release hatchery reared smolts from Mendenhall to provide fish for the Juneau area fisheries.

Coho Stock Selection:

Data collected in 1977 indicate that the Mendenhall, Auke Lake and Blind Slough stocks all entered the Juneau area from August 15 to 27. Because the arrival of the three stocks coincides with the opening of commercial troll season in District 111, I believe there were probably some fish of all stocks present in the local area prior to the commercial opening; however, the existing sport fishery was not intense or efficient enough to catch significant numbers of them. Of all recoveries used in evaluations of different stocks in the Juneau area, only four, or 6%, were recovered prior to August 15, the opening of commercial troll season in District 111-A. The remaining 67 (94%) recoveries were made after opening of the commercial troll season in District 111-A. Data collected in May, 1977 indicate that the three stocks entered the Juneau area later than they actually did because of the many fold increase in fishing pressure beginning August 15, the opening of commercial trolling. In 1978, recoveries of tagged wild coho in Taku Inlet and Lynn Canal summer gill net fisheries will help to confirm timing of the wild stocks as the fish must pass through the local Juneau area entering to the gill net areas.

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RESEARCH PROJECT SEGMENT

State:	ALASKA	Name:	Sport Fish Investigations of Alaska
Study No.:	AFS 43	Study Title:	MENDENHALL ANADROMOUS FISH REARING PONDS
Job No.:	AFS 43-6	Job Title:	Coho Brood Stock Development

Period Covered: July 1, 1977 to June 30, 1978

ABSTRACT

Studies conducted under this job in 1977 were designed to: (1) collect timing and recovery data on coded wire tagged stocks of wild coho in the Juneau area in order to select the most desirable stock for use in Juneau rearing facilities and (2) determine if saltwater reared coho smolts are capable of returning as adults to a freshwater release site (Mendenhall Lakes Facility).

Approximately 62,100 coho taken in the Juneau area were examined by project samplers in 1977, and 83 coded wire tagged fish were recovered. Seventy-one recoveries of adult coho showed the time of arrival in the Juneau area of Mendenhall stock coho to be August 28, Blind Slough stock released from Fish Creek Rearing Facility to be August 30, and Auke Lake stock and Blind Slough stock released from the Mendenhall Facility to be September 5.

Of the three experimental lots released in spring, 1977 to test the feasibility of releasing saltwater reared smolts from the facility a total of 127 coho jacks returned to the Mendenhall Facility in fall, 1977. Data indicate that jacks from smolts reared in Moose Lake returned at a rate of 1.048% of the smolts released, compared to .217% for saltwater reared smolts released from the facility, and .175% for hatchery reared smolts released from the facility.

BACKGROUND

Mendenhall Lakes reared coho were first taken in the Juneau area fisheries in 1975 (Figure 1). In that year poor returns of wild coho were realized and subsequently Mendenhall Lakes reared coho made up 6.1% (333/5,457) of the Juneau area marine sport catch. (Bethers, 1976).

In 1976, returns of wild coho to the Juneau area were much stronger than in 1975. With more wild coho available to the local sport fishermen, Mendenhall reared coho contributed only, or 1.1%, of the 7646 total marine sport catch. (Bethers, 1977).

Catch data collected on Mendenhall stock coho in 1975 and 1976 indicate that these fish entered the local Juneau area from August 20 to 26, during the

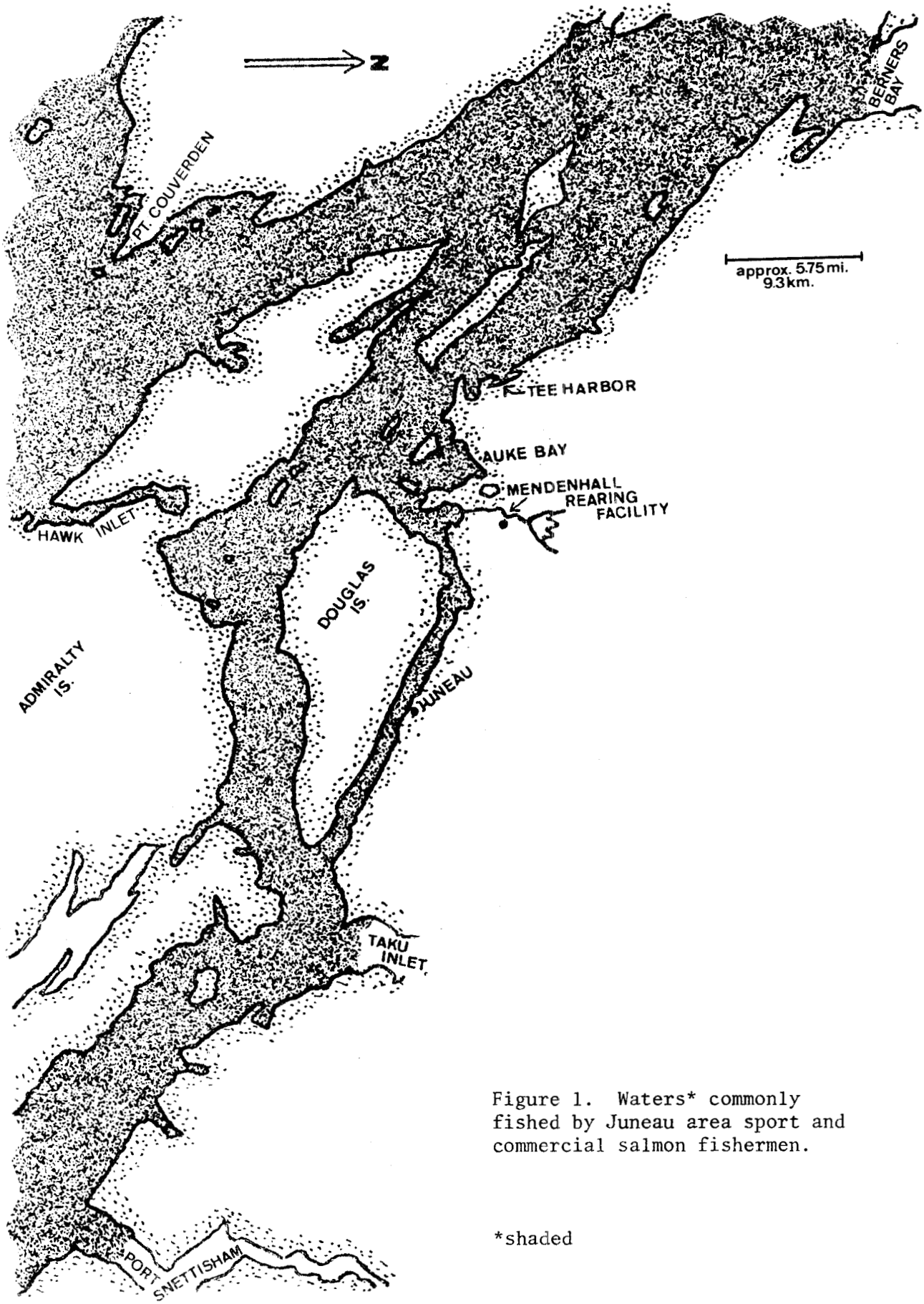

Figure 1. Waters* commonly fished by Juneau area sport and commercial salmon fishermen.

*shaded

peak of sport fishing activity; however, most recoveries were made during September, well past the peak of sport fishing activity.

The low contribution of artificially reared coho to the sport fishery is probably due to the majority of Mendenhall stock coho returning to the Juneau area during the peak of commercial troll season and after the peak of the sport fishery. Also, because the Mendenhall stock is a short-run, late returning stock, a portion of the returning adults may enter the Juneau area in a "non-biting" condition which is common with coho prior to ascending spawning streams.

It was believed that we would have the greatest chance of improving the local sport fishery by developing a stock of coho that returns to the Juneau area early in the season and spends more time available to the Juneau area sport fishermen prior to August 15, the opening of the local commercial troll season. Also, earlier in the season there would be fewer wild coho available for the local sport fishermen.

It was decided that in 1977 this project would cease artificial rearing of the Mendenhall stock coho at the facility and would begin an evaluation of contribution to the local fisheries and timing through the Juneau area of 12 wild stocks of coho the Department has coded wire tagged. By comparing recovery dates of the 12 stocks in the Juneau area, the one which spends the most time available to the local fisheries could be selected for potential use at the rearing facility.

It is believed that a maximum number of locally reared smolts might be produced for the local fisheries by cooperative efforts between the Mendenhall Lakes and Fish Creek Estuarine Rearing Facilities. In 1977, this project began two experiments in cooperation with the Fish Creek Estuarine Rearing Facility operated in the estuary of the Mendenhall River by the Division of Fisheries Rehabilitation, Enhancement and Development (F.R.E.D.). One experiment was to determine the capability of estuarine reared coho smolts to adapt to fresh water for release and to return as adults to the release site. The second is to determine the feasibility of transferring coho reared to "near smolt" condition at Mendenhall Lakes to the Fish Creek Facility for overwintering and spring release.

If it is learned that adult coho from estuarine reared, freshwater (Mendenhall) released smolts will return to the fresh water release site, smolts reared at the Fish Creek Facility could be used to maintain broodstocks at Mendenhall Lakes and rebuild local depressed stocks of wild coho. If it is learned that adult coho from Mendenhall reared, Fish Creek released smolts contribute well to the local fisheries, perhaps the Mendenhall Facility would become a freshwater "prepping" station for rearing large numbers of coho to a size where they could be transferred to the estuarine rearing facility for overwintering, additional feeding and release.

Since the local commercial troll catch is many fold the sport catch, the Mendenhall Project in 1977 provided three commercial catch samplers to collect data on tagged wild stocks of coho and coho returning to the Mendenhall Lakes and Fish Creek Rearing Facilities.

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Since the local commercial troll catch is many fold the sport catch, the Mendenhall Project in 1977 provided three commercial catch samplers to collect data on tagged wild stocks of coho and coho returning to the Mendenhall Lakes and Fish Creek Rearing Facilities.

In 1977, this program inspected approximately 62,100 commercially caught coho, 55% of the Juneau area troll catch. A total of 71 individual adult coho from one wild stock, Auke Lake, and from Mendenhall Lakes and Fish Creek rearing facilities were recovered (Davis, 1978). Adult coho from all tagged wild stocks will be present in the fisheries in 1978, when comparable data on them will be collected.

RECOMMENDATIONS

1. Evaluation of availability and contribution to the Juneau area fisheries of 12 wild stocks of coho the Department has coded wire tagged should continue. By comparing recovery dates of the 12 different stocks, the stock that spends the most time available to the Juneau area fisheries can be selected. Recoveries will be made by monitoring sport and commercial fisheries in the Juneau area, by inspecting samples of sport and commercial salmon catches for marked fish, and by interviewing fishermen to collect exact catch date and location data.

   In 1978, there should be many more tagged adult coho from the wild stock available to the fisheries than in 1977. Therefore, I feel with normal survival of wild coho and fishing pressure similar to that of 1977, a sampling program like that used in 1977 should recover an adequate number of tagged fish from the troll and gill net fisheries in 1978 to select the most desirable stock of coho for use in the Juneau area rearing facilities.

   a. Adult coho from the 12 wild tagged stocks will be present in the Juneau area fisheries in 1978. Catch date and location data will be compiled as it is collected through the summer. Sufficient data will be collected by late summer to select the best stock for improving the local fisheries. An experimental egg take from the selected stock should be made in fall, 1978.

2. Work should continue to determine the capability of saltwater reared coho to adapt to fresh water for release and return as adults to the release site. The Fish Creek Saltwater Rearing Facility located in the estuary of the Mendenhall River is potentially a "high production" facility and in the future will be rearing up to 500,000 coho smolt annually.

   a. If it is determined that saltwater reared, freshwater released, coho smolts survive and return to freshwater release sites as adults, smolts from the Fish Creek Saltwater Rearing Facility could be used for development and maintenance of brood stocks at freshwater egg take sites and for rebuilding local depressed stocks of coho.

   b. In 1977, jack coho from releases of saltwater reared smolts released at Mendenhall were recovered from the holding facility. In 1978, returning adult coho should be recovered from the holding pond for determination of release lot and evaluation of return of three lots of coho released in 1977.

OBJECTIVES

1. Develop the most desirable brood stock of coho for use in improving the Juneau area marine sport fishery.

2. Determine feasibility of imprinting coho smolts to the Mendenhall Facility that have been reared in saltwater pens.

TECHNIQUES USED

Coho Stock Selection

Wild coho stocks which this program is evaluating for use in improving the Juneau area sport fishery were marked in 1976 by the Division of Commercial Fisheries Coho Research Program. Rearing coho were marked as follows:

STOCK	CWT CODE	TAGGED	ADULTS ENTER FISHERIES
Auke Lake	4-3-10, 4-3-11	2,992	1977
Berners River	4-2-15, 4-3-8	11,343	1978
Yehring Creek	4-3-1	484	1978
Johnson Creek	4-3-9	1,352	1978
Sockeye Creek	4-3-3	3,214	1978
Moose Lake (Taku R.)	4-3-4, 4-3-5	4,670	1978
Speel Lake	4-4-10	7,535	1978
Mosquito Lake	4-3-2	3,347	1978
Chilkat River	4-3-6	1,019	1978
Chilkat Lake	4-5-2	2,985	1978
Haines Airport Ponds	4-5-3, 4-5-4	5,070	1978
Chilkoot Lake	4-3-7	1,503	1978
Total		45,514	

Return data collected on 1974 brood Mendenhall stock and Blind Slough, Alaska stock coho released from the Mendenhall Facility are presented for comparison with wild stocks. Data collected on Blind Slough stock coho released from the Fish Creek Estuarine Facility were analyzed to determine if releasing smolt into salt water had an effect on subsequent returning adults' availability to local marine fishermen and to compare with freshwater releases of Blind Slough coho released at Mendenhall.

Coho released from the Fish Creek Facility in 1976, of which return data is presented in this report, were marked as follows:

Stock	CWT Code	No. Tagged
Blind Slough	4-4-15	21,951
Blind Slough	4-5-1	21,681
Total from facility		43,632

Coho released from the Mendenhall Facility in 1976, of which return data is presented in this report, were marked as follows:

Stock	CWT Code	No. Tagged
Mendenhall	4-4-2	14,180
Mendenhall	4-4-3	2,430
Mendenhall	4-4-4	4,233
Blind Slough	4-4-14	14,695
Total from facility		35,538

Only marked adult coho recovered were included in evaluations presented in this report.

Commercial catch samplers worked at the following locations during the time periods indicated in 1977:

Juneau Cold Storage	May 12 - September 20
Tee Harbor Buying Station	July 16 - September 20
Auke Bay Buying Station	August 16 - September 20

A temporary biologist was stationed at the Juneau Cold Storage Plant. This person inspected troll caught fish brought into Juneau on "outside" trollers and tenders in addition to inspecting Juneau area caught salmon sold at the Cold Storage. This person also supervised sampling at Auke Bay and Tee Harbor buying stations. Fish buyers at Tee Harbor and Auke Bay were hired to inspect fish as they were off-loaded from fishing boats. Upon landing of a load of fish, samplers questioned the fishermen about the area fish were caught. When an adipose clipped fish was found, the exact location of capture was

determined. Information including catch date, location, and fisherman's name and address were recorded on a waterproof tag which was attached to the fish's jaw. These fish were iced along with other unmarked fish for transfer to Juneau Cold Storage Plant. Buying station operators delivered fish to the plant usually daily throughout the season. Records kept daily by the sampler included the number of fish inspected by species, by area, and the number of marks found; therefore, fish inspected at the buying station did not need to be counted or re-sampled in any way at the plant. As these fish were processed, Cold Storage employees heading the fish retained "tagged" heads in two "head buckets" kept under the work table. Fish sampled at the Juneau Cold Storage Plant were tagged like those discovered at buying stations and heads were saved as noted above.

Frozen heads were stored at both Juneau Cold Storage and at the Alaska Department of Fish and Game Regional Lab in Juneau. Detection and removal of coded wire tags were done at the Fish and Game Lab. Coded wire tags recovered were read on a N.M.T. coded wire tag jig under a 0.7x-3x Bausch and Lomb binocular microscope. Tags were stored in 80 mm x 44 mm x 28 mm plastic boxes with 50 individual compartments.

Coded wire tags recovered from heads turned in by anglers were also included in catch date and location data as were recoveries made by the sport fish creel census (Robards, 1976, 1977, 1978).

Secondary Imprinting

A total of 39,110 coho smolts in three lots were released from the Mendenhall Lakes Facility in spring, 1977. All lots were of 1975 brood Mendenhall stock. Three lots of smolts released in spring, 1977 from the Mendenhall Facility were marked as follows:

Lot	Release Date	No. Released	No./lb. (kg)	Average Fork Length (mm)	CWT Code
Moose Lake	4/20-21/77	6,197	26.6 (58.6)	118.6	4-16-42
Fish Creek	4/27-28/77	10,097	31.0 (68.3)	111.6	4-2-7
Crystal L. Hatchery	5/4-10/77	22,816	20.9 (46.0)	127.0	4-16-40
		39,110			

All three of the above lots were from eggs collected at the Mendenhall Lakes Rearing Facility in fall, 1975. The "Moose Lake" lot was raised to a size of 545/lb. (1,202/kg) at Crystal Lake Hatchery and then on June 6, 1976 transferred to Moose Lake for pond rearing. These fish were overwintered in Moose Lake and released in spring, 1977 at a size of 26.6/lb. (58.6/kg).

The "Fish Creek" lot was the primary experimental lot released in spring, 1977. The "Moose Lake" and "Crystal Lake Hatchery" lots were released for comparative purposes and to help insure an egg source in 1978. The Fish Creek lot was pond reared in Moose Lake from June 6 through September 16, 1976. On September 16, 17, and 18, a total of 99,439 coho in "near smolt" condition were removed from Moose Lake and transferred to Fish Creek Estuarine Rearing Facility for overwintering and additional feeding. The "Fish Creek" lot was transferred back to the Mendenhall Facility for imprinting and release in spring, 1977. The fish averaged 29/lb. (63.9/kg) when transferred to the Mendenhall Facility for release.

The "Crystal Lake" lot was raised from the egg to smolt stage at Crystal Lake Hatchery and transferred to the Mendenhall Facility for release directly prior to imprinting and release.

All fish marked prior to release were adipose clipped and coded wire tagged (CWT), with a separate code for each of the three lots. Tagging was conducted in a skid shed 2.44 m (8 ft.) wide x 3.66 m (12 ft.) long with clear visqueen plastic sides and roof, adjacent to the holding pond. Fish for marking were dipnetted from the net pens, carried in buckets to an anesthetic (MS-222) trough where they were clipped after being anesthetized. After adipose clipping (Lawton surgical shears No. 19-0305) fish were placed in a holding basket while waiting to be coded wire tagged. After tags were injected (N.M.T. MK 1-A injector) fish were dropped into a quality control device (N.M.T.) which separated tagged from non-tagged smolts. Tagged smolts were transferred to the holding pond in approximately one foot of water for recovery. Non-tagged smolts were routed by the quality control device into a bucket for rechecking. Rechecked smolts were dropped through the quality control device an additional two times before they were considered a "re-tag" and placed in the holding basket for "re-tagging". Re-tagged fish were tallied and deducted from the daily number of fish tagged on the injector counter. Accuracy of the quality control device was checked periodically by use of a N.M.T. field detector. Water pumps used for the tagging operation were two Japsco "Water Mule" 3/4 hp., (13 gpm.) pumps. One was used to fill and circulate water in the anesthetic/clipping troughs, and one was used to provide a water supply for the quality control device. Electric power for the tagging operation was supplied by an Onan diesel 3 kw generator.

Personnel used for adipose fin-clipping and coded wire tagging fish consisted of the following:

PERSONNEL	OPERATION
1	- Fish transport, pens to clipping troughs, quality control device operator
2	- Fin clippers
1	- Handing clipped fish to injector operator
1	- Injector operator
5	- Person crew

After recovery in the holding pond, smolts were allowed to out-migrate from the pond of their volition.

Survival and return to the facility of the three lots of coho will be determined by recovery of coded wire tags from coho returning to Mendenhall in 1977 and 1978.

In 1977, returning coho were allowed access to the holding pond through a trap entrance that prevented downstream escape. Fish were confined to the holding pond by weirs on the two inlets to the pond. All jack coho seined during egg takes or found dead in the weir or holding pond were collected for detection of coded wire tags. All jacks, adipose marked and not marked were checked for presence of coded wire tags by use of a N.M.T. detector. Tags on which the sample number and length of fish were recorded were attached to the jaw of all adipose clipped fish. Heads were saved for later extraction of coded wire tags.

Measurements were recorded and coded wire tags extracted in the Regional Department of Fish and Game Lab in Juneau. Tags were read on a N.M.T. tag jig under a 0.7x-3x Bausch and Lomb binocular microscope.

Recovery locations of tagged adult coho in the Juneau area of which exact catch location was determined are presented in Figure 3. Please note that Figure 3 shows a distribution of catch of tagged adult coho which may not be a distribution of tagged coho in the Juneau area, as the primary locations of recovery are also locations receiving the greatest fishing pressure within the area.

FINDINGS

Coho Stock Selection

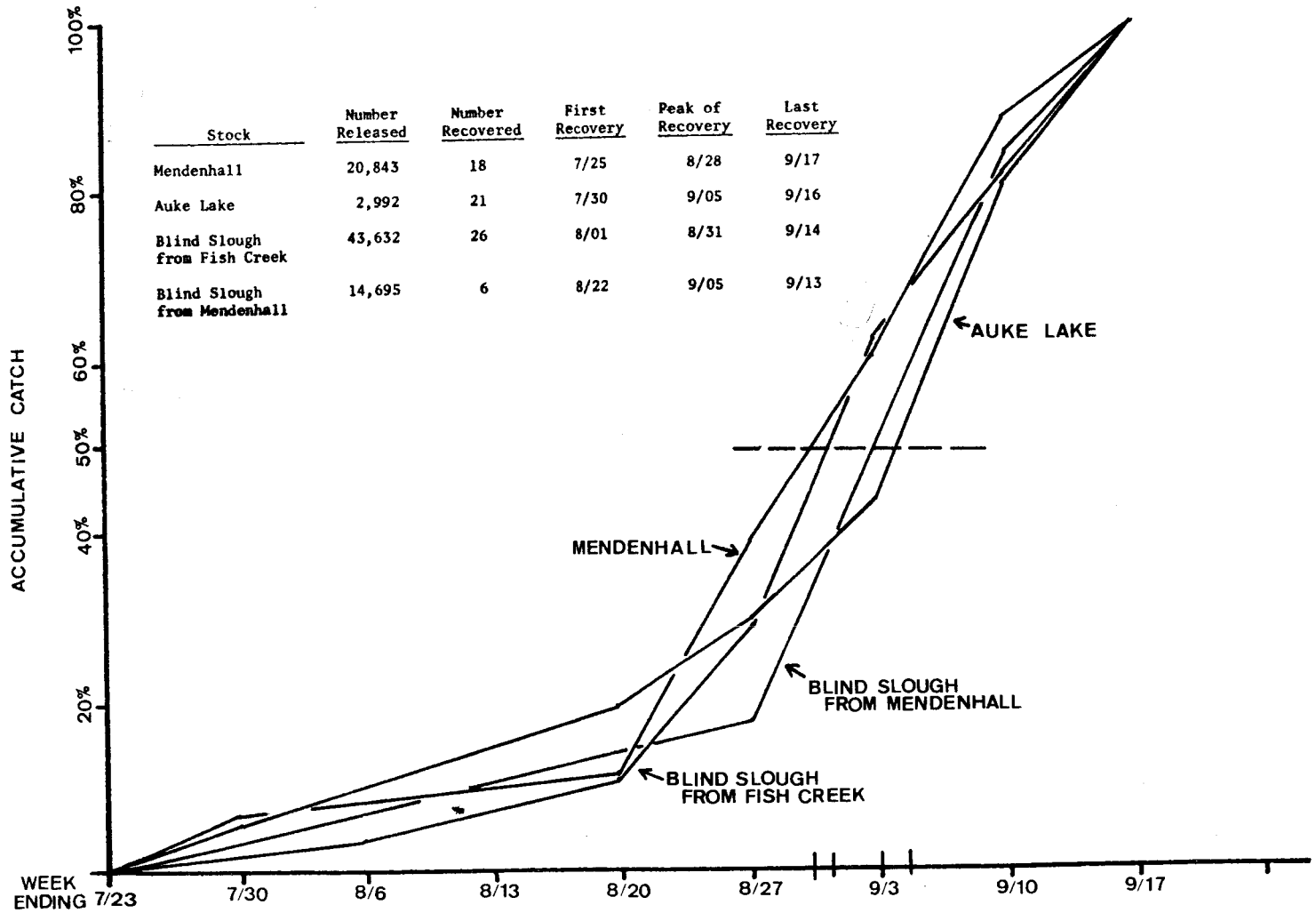
A total of 71 adult coho with coded wire tags were recovered from commercial and sport fishermen in the Juneau area in 1977. Of those recovered, 21 were of Auke Lake stock, 18 were of Mendenhall stock released from the Mendenhall Facility, 26 were of Blind Slough stock released from Fish Creek Estuarine Rearing Facility and 6 were of Blind Slough stock released from the Mendenhall Facility.

The Mendenhall coho stock appeared to arrive and peak somewhat earlier in the fishery than the other stocks tested (Figure 2). However, there appeared to be little difference between the different stocks, and most peak catches occurred during an eight day period from August 28 through September 5.

The first recovery of a Mendenhall stock coho in the Juneau area in 1977 was made July 25. The remaining 17 tags were recovered from August 16 to September 17, 1977. Fifty percent of the recoveries made in the Juneau area were obtained by August 28, and 58% of recoveries were made prior to August 31.

A total of 21 tags were recovered from the Auke Lake coho in the Juneau area from July 30 to September 16, 1977. Two recoveries (July 30 and August 14) were made prior to the opening of the commercial troll season. Fifty percent

Figure 2. Apparent dates of recovery in the sport and commercial fisheries of three stocks of coho in the Juneau (Districts 11 and 12) in 1977.



Stock	Number Released	Number Recovered	First Recovery	Peak of Recovery	Last Recovery
Mendenhall	20,843	18	7/25	8/28	9/17
Auke Lake	2,992	21	7/30	9/05	9/16
Blind Slough from Fish Creek	43,632	26	8/01	8/31	9/14
Blind Slough from Mendenhall	14,695	6	8/22	9/05	9/13

of the Auke Lake recoveries made in the Juneau area were obtained by September 5, and only 38% of the fish recovered were recovered by August 31, 1977.

A total of 26 tags were recovered from Blind Slough stock coho released from the Fish Creek Estuarine Facility, the first being on August 1. The remaining tags were recovered from August 19 through September 14. Fifty percent of tags recovered were obtained by August 31.

Six Blind Slough tags were recovered between August 22 and September 13, and 50% of the recoveries were obtained by September 5, 1977.

Most of the tagged fish taken in the Juneau area were caught at Lena Point, Hand Trollers Cove, Eagle Beach and Outer Point (Figure 3). These recoveries mostly reflect the areas of greatest fishing pressure.

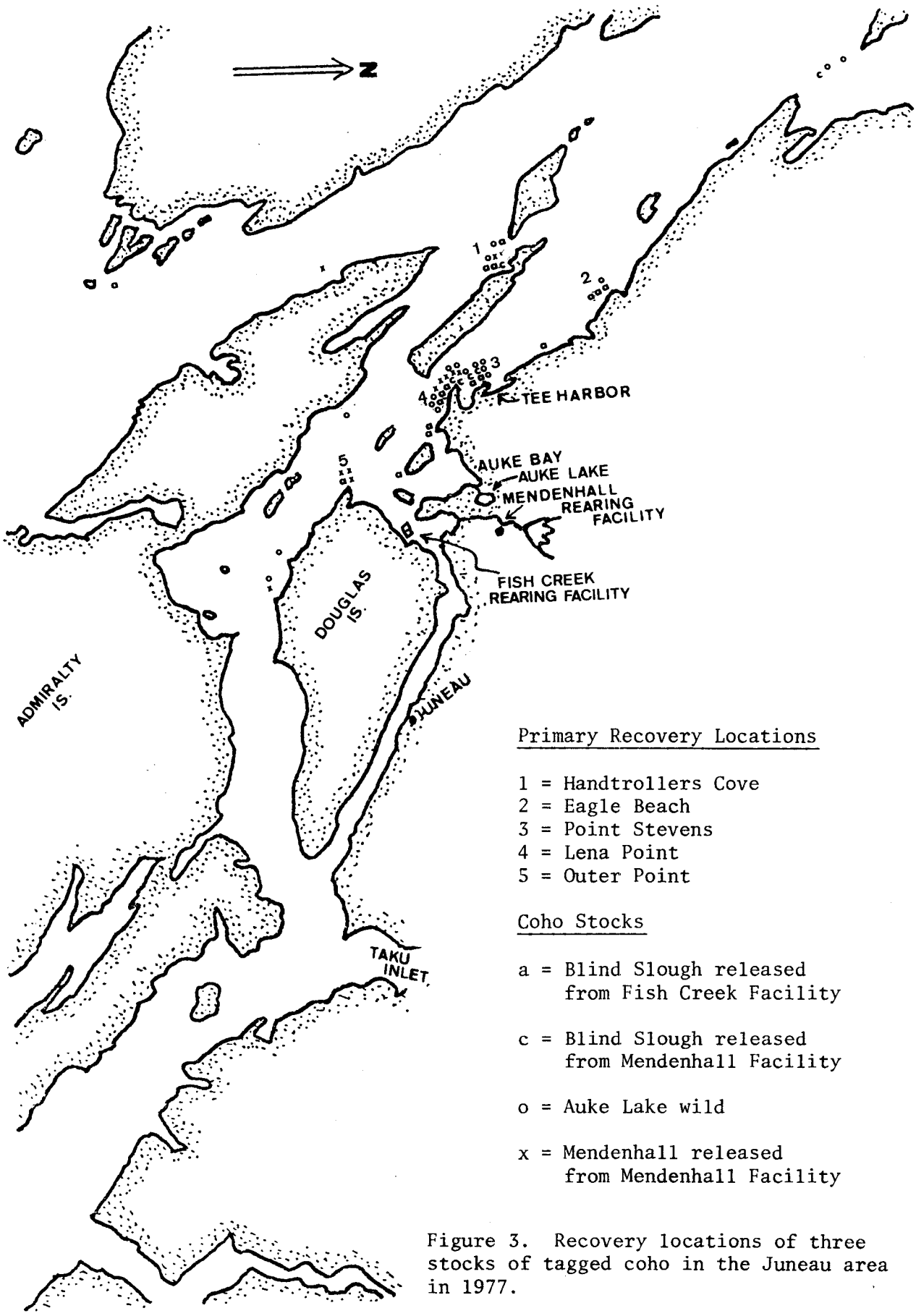
In addition to the recoveries of tagged coho in the Juneau area, a total of 81 tagged coho were recovered elsewhere in northern Southeast (Table 1). From these recoveries it appears that the migration route into the Juneau area from the offshore waters is through Icy Strait, Chatham Strait and around Point Retreat (Figure 4). Here again the areas of major recovery are areas receiving the greatest fishing pressure i.e. (beach areas of southern commercial District 116 and northern areas of District 113). Please remember that the large number of recoveries in the Juneau area is due in part to a more intense sampling program than on the outside coast.

Secondary Imprinting

Coho reared at the Fish Creek Saltwater Facility were released as smolt from the Mendenhall Facility in spring, 1977. This was done to test the feasibility of imprinting coho to fresh water after being reared in a salt water facility. Adults from the release are not expected to return until the fall of 1978.

Of the fish released, 22 jacks returned to the facility in the fall of 1977. Compared to other lots released from the facility the return was:

Rearing Location	CWT Code	Number Released	Smolt F.L. (mm)	Jack Return	Percent Jack Return
Moose Lake	4-16-42	6,197	118.6	65	1.048
Fish Creek	4-2-7	10,097	111.6	22	.217
C.L. Hatchery	4-16-40	22,816	127.0	40	.175
Total		39,110		127	



Primary Recovery Locations

1 = Handtrollers Cove
2 = Eagle Beach
3 = Point Stevens
4 = Lena Point
5 = Outer Point

Coho Stocks

a = Blind Slough released from Fish Creek Facility

c = Blind Slough released from Mendenhall Facility

o = Auke Lake wild

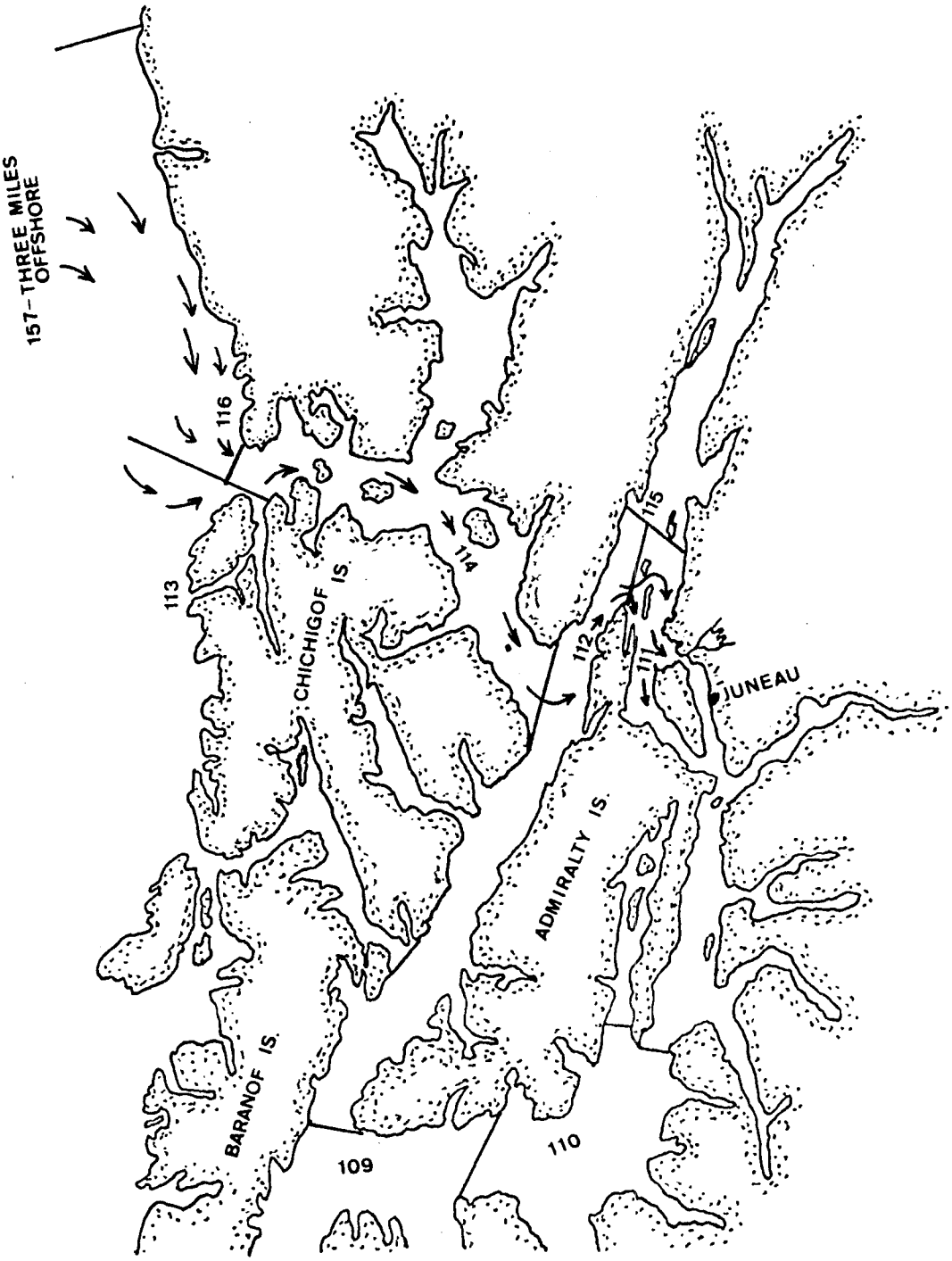
x = Mendenhall released from Mendenhall Facility

Figure 3. Recovery locations of three stocks of tagged coho in the Juneau area in 1977.

Table 1. Distribution of recoveries by commercial district in the 1977 northern Southeast Alaska troll fishery of three stocks of coho tagged and released in the Juneau area.

Commercial District	Mendenhall Stock Released @ Mendenhall		Auke Lake Stock Wild		Blind Slough Stock Released @ Mendenhall		Blind Slough Stock Released @ Fish Creek	
	(n)	% Catch	(n)	% Catch	(n)	% Catch	(n)	% Catch
157	3	6.8	1	2.3	0	0	2	3.5
116	11	25.0	10	23.3	2	25	23	40.4
113	9	20.5	5	11.6	0	0	9	15.8
114	5	11.4	3	7.0	0	0	4	7.0
"Juneau Area" 111/112	16	36.3	24	55.8	6	75	19	33.3
	44	100%	43	100%	8	100%	57	100%

Figure 4. Probable migration route of coho into the Juneau area by commercial district (based on recoveries of coded wire tagged coho in 1977).



Only one fish from the lot of hatchery reared smolts and one fish from the lot of saltwater reared smolts were known to have been taken in the fisheries in 1977. Therefore, the fisheries are not believed to have a significant effect on the return of jacks to the facility in 1977.

DISCUSSION

Coho Stock Selection

One could assume that a sample of 62,000 coho or 55% of the total catch would be much larger than necessary for some statistical expansion and analysis; however, when one is searching for tagged fish from release lots as small as 500 fish, as many fish as possible must be inspected.

Data collected in 1977 indicate that the Mendenhall, Auke Lake and Blind Slough stocks all entered the Juneau area from August 15 to 27. Because the arrival of the three stocks coincides with the opening of commercial troll season in District 111, I believe there were probably some fish of all stocks present in the local area prior to the commercial opening; however, the existing sport fishery was not intense or efficient enough to catch significant numbers of them. Of all recoveries used in evaluations of different stocks in the Juneau area, only four, or 6%, were recovered prior to August 15, the opening of commercial troll season in District 111-A. The remaining 67 (94%) recoveries were made after opening of commercial troll season in 111. Data collected in 1977 may indicate that the three stocks entered the Juneau area later than they actually did because of the manyfold increase in fishing pressure beginning August 15, the opening of commercial trolling. In 1978, recoveries of tagged wild coho in Taku Inlet and Lynn Canal summer gill net fisheries will help to confirm timing of the wild stocks as the fish must pass through the local Juneau area enroute to the gill net areas.

Broodstock Development

Because of the great difference in jack return between pond reared smolts and saltwater reared smolts imprinted to the facility, it is assumed that return to the facility in 1978 of adult coho from saltwater reared smolts will be much less than that of pond reared smolts released in the same experiment.

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